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A POPULATION STUDY OF *EUPTYCHIA HERMES* IN NORTHERN FLORIDA

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THE POPULATION BIOLOGY of the satyrid butterfly *Euptychia hermes* Fabricius has been described in relation to a tropical population (Emmel, 1970). However, little work has been done on the species in the northern temperate zone. Since this *Euptychia* ranges in the United States as far north as the New England states along the Atlantic Coast and as far south as central South America, comparative population studies should be of considerable biological interest. The present paper treats a population in Gainesville, northern Florida.

MATERIAL AND METHODS

Euptychia hermes is a small dull brown-gray butterfly with a wingspread of approximately 25 mm. Its underside has conspicuous submarginal ocelli and is lighter colored than the dorsal surface of the wings. The larvae of the species feed on grasses but the adults appear to spend much time amongst decaying leaf litter found on the forest floor. The characteristic flight movement rarely exceeds two feet in height or five feet lateral distance and is especially distinguished by a very slow beating of the wings. Little or no variation was observed from unidirectional flight except in times of pursuit. Having alighted on a surface, *E. hermes* does not open its wings; rather, it folds its wings over the thorax and orients toward the sun. This results in a minimization of the shadow cast.

The locality in which this population study was undertaken was in a thinly wooded area south of Bartram Hall on the University of Florida campus in Gainesville. The immediate area included an apiary, used by the Department of Entomology, two rarely used wooden buildings, and a greenhouse (see Fig. 1). North of these buildings in the area studied were a number

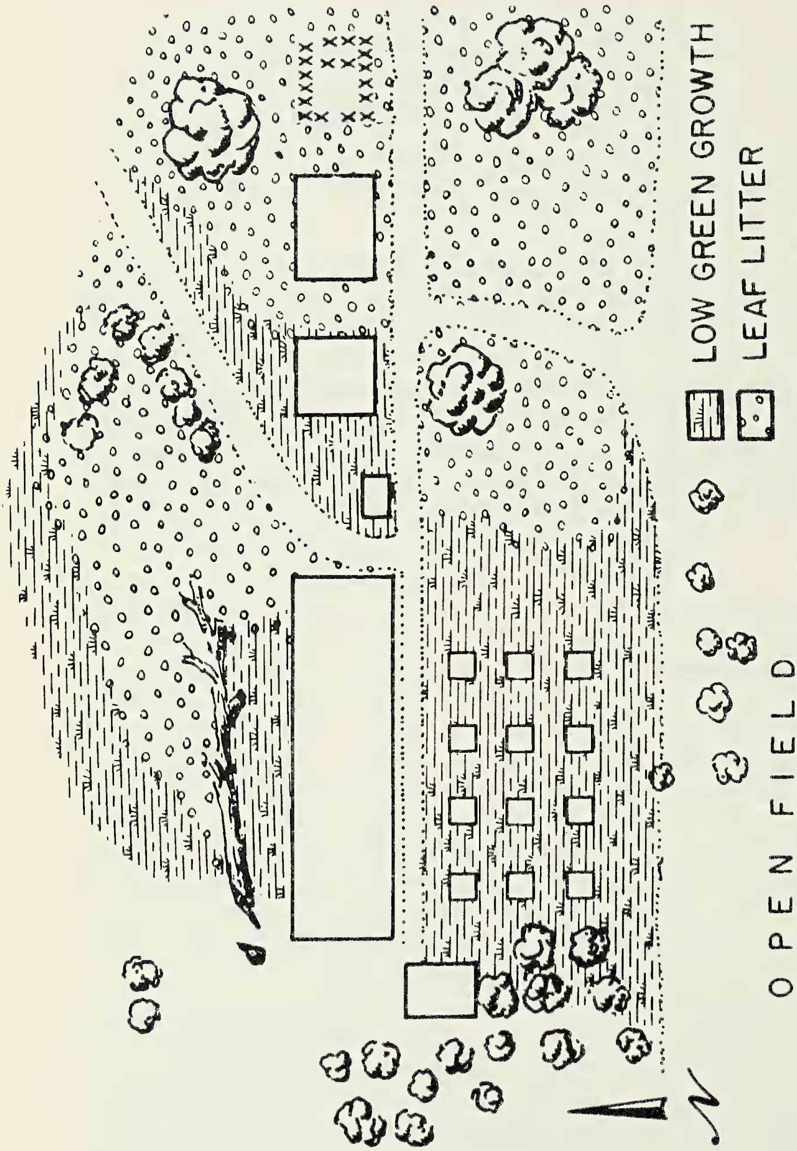

Fig. 1.—Map of the partially wooded area on the University of Florida campus where the present population study of *Euptychia hermes* was undertaken. Dotted lines indicate pathways through area. The apiary mentioned in the text is represented by small boxes at lower left. The east-west distance across the map is approximately 70 yards.

of pines but south of them were only two or three deciduous trees (hardwoods). However, one of these consistently had three or so individuals within five feet of its base and was initially thought to support a separate population (Tree A in Figure 1). The floor was worn by paths in some places but generally was covered by either decaying litter or short (¾ m or less) green growth as noted in Fig. 1. North and east of this area was a less densely forested area of pines and south of it was an open field of low cropped green grass. For less than 15 m west of the area extended denser, wooded growth bounded by a campus road. The total area was approximately 70 m x 40 m.

A capture-release-recapture program was initiated on May 14 and continued until May 26, 1972, to determine population size as calculated by three applicable standard methods for population estimation. Specimens were marked with a green Magic Marker pen on their wings according to a 1-2-4-7 coding system (Ehrlich and Davidson, 1961). Collection was done for one hour periods each day from 3:45 to 4:45 P.M. as this time was found by observation to be a period of high activity for the butterflies and convenient for the author. Because *E. hermes* is a low-flying species, the most effective method of collection was waiting for flying individuals to land and then quickly placing the net over the insect. Raising the bag resulted in the specimen flying to the top. Individuals caught in this manner were held in nets until the collection period had terminated and were then released after marking.

The boundaries of the population were initially estimated by obvious geographic features and then adjusted after sampling gave a better indication of adult distribution. At three-day intervals, collection was attempted outside the tract depicted in Fig. 1. At no time was a marked individual seen or caught beyond the designated boundaries. Only one unmarked specimen was caught during these hours, approximately 40 m northeast of the collection area.

RESULTS

The capture-recapture data resulting from this work is summarized by the trellis diagram in Fig. 2. Estimates of population size (see Table 1) were obtained with these data using three statistical methods.

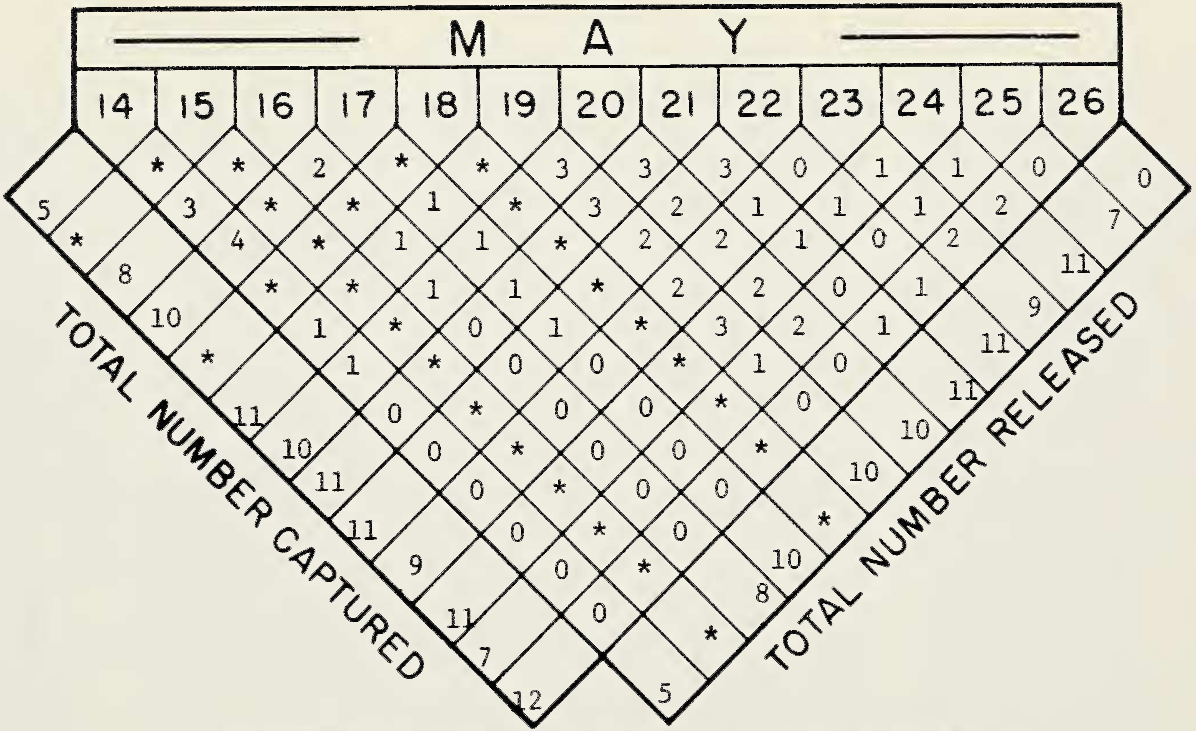

Fig. 2.—Trellis diagram summarizing capture-recapture data on a population of *Euptychia hermes*, May 14-26, 1972. The actual numbers of captures, releases and recaptures are given for each date. On May 14th, for example, 5 adults were captured (left diagonal) and 5 adults were released after marking (right diagonal); 3 of these were recaptured (and released again) on May 16th, 4 were recaptured on May 17th, and 1 on each day of May 19th and 20th, with none originally marked on May 14th appearing after the 20th. Asterisks indicate no field work on May 15 and 18 due to bad weather.

1. *Modified Lincoln Index* (Bailey, 1951):

$$P_1 = \frac{(N_2 + 1)\ M_1}{R_2 + 1}$$

where P_1 = population size on day one
M_1 = the number marked on day one
N_2 = the total number of captures on day two, and
R_2 = the number of recaptures on day two

2. *Bailey's Triple Catch Method*

$$P_2 = \frac{M_2\ N_2\ R_{3_1}}{R_{2_1}\ R_{3_2}}$$

where P_2 = population size on day two,
M_2 = number of individuals marked on day two,
R_{3_1} = number of recaptures taken on day three and marked on day one,
R_{2_1} = number of recaptures taken on day two and marked on day one, and
R_{3_2} = number of recaptures taken on day three and marked on day two.

3. *Capture per Unit Effort* Method (DeLury, 1947):

$$\frac{\text{No. captured at } t_0}{P_0} = \frac{\text{No. captured at } t_1}{P_1}$$

where P_0 = population size at time 0 and
P_1 = population size at time 1.

The population estimates for the modified Lincoln Index were calculated by a straightforward application of the formula. There was some problem in applying the Triple Catch Method of Bailey, which requires three consecutive days of data, because on May 23rd no recaptures were taken of individuals marked on the previous day. Thus, no estimates were available for either day and the same held true for the 25th and 26th of May. In using the Capture per Unit Effort method, the estimate for May 14 was taken directly from the modified Lincoln Index and this was used as Pt_0 in the formula. Because this is a successive formula, the choice of initial population size influenced the population estimates for all later dates. The direct count of the total number caught is given for a means of comparison of the estimates to the minimum population size.

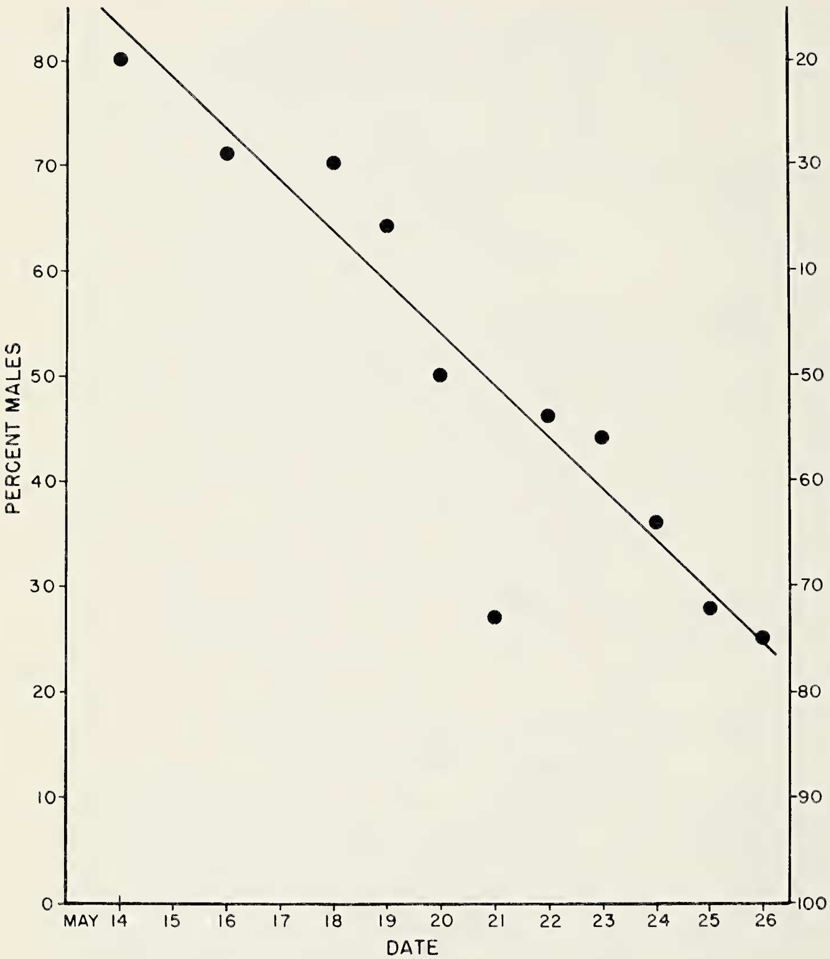

Fig. 3.—Decreasing percentage (left axis) of males in *E. hermes* population from May 14 to 26, 1972. The increasing percentage of females in the population is indicated on the right axis.

As is evident from the table, the greatest agreement is between the estimates derived from the modified Lincoln Index and the Capture per Unit Effort Method up to May 20th. Thereafter, a one-day lag in sensitivity between these two methods is noticed. These two methods also show a closer correlation with the direct total count than the Triple Catch Method. Intuitively speaking, the direct total count would be a reliable indicator of population size in this specific case because all individuals that were seen in the area each day were caught within the first 30 minutes of collection. If a balance between birth and death rate is assumed and since no emigration was observed, the only factor unaccounted for is immigration. This factor could explain the difference between estimated and direct counts. The smaller correlation between the Triple Catch Method estimate and direct count may be due to a lack of sensitivity to the small number of recaptures. The modified Lincoln Index has a correction factor for this and the Capture per Unit Effort Method calculations may have benefited by the use of the modified Lincoln Index figure for May 14.

Some of the most interesting data from the capture-recapture program were the changes in sex ratio during the 12 days. As the work progressed, there was a noticeable decrease in the number of males captured in relation to females. The decreasing percentage of males and corresponding increase in females captured is portrayed graphically in Fig. 3. A possible explanation of the increase in number of females is that a new, second generation of this multiple-brooded species is emerging at this time of year. At this point in the emergence of the adults of the population, males would have largely completed emergence earlier in the season and female emergence would now be reaching a peak. Another factor influencing the apparent sex ratio may be that the mature females would be flying about in the grasses laying eggs and hence perhaps be more active than males at this particular time.

Finally, Fig. 4 and 5 illustrate the number of times individuals were recaptured on different days. The marked decline in the graph is due to the short life span of the adults and the intersect on the horizontal axis indicates a maximum life expectancy of approximately 6.25 days for this *Euptychia hermes* population. Thus the graph itself approximates a survivorship curve. The survival rate (r_/) at a particular time can be obtained by calculating the slope of the curve at that point. The survivorship rate declines strongly near the maximum life span.

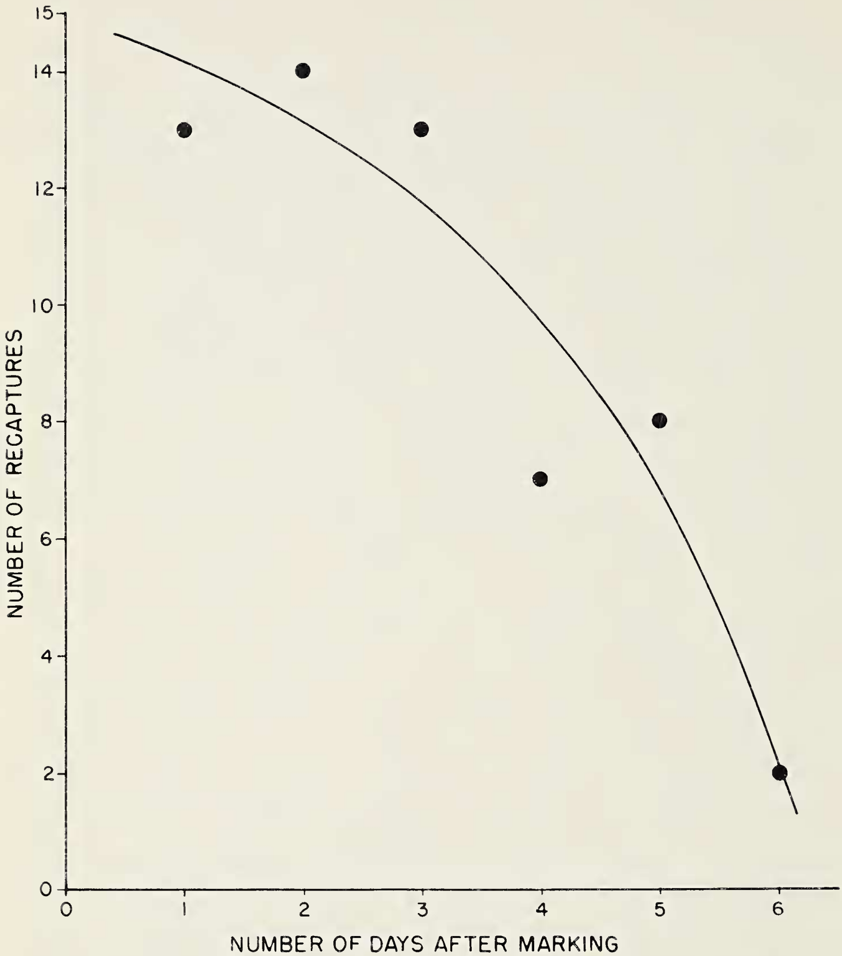

Fig. 4.—The number of recaptured specimens taken on successive days following initial marking. This graph gives an approximation of the survivorship curve for adult *Euptychia hermes* in this Gainesville, Florida population. The maximum expected life span in the wild is approximately 6.25 days.

SUMMARY

A project comparing three standard methods of population estimation was conducted with the satyrid butterfly, *Euptychia hermes* Fabricius, on the University of Florida campus in Gainesville. The modified Lincoln Index and Capture per Unit Effort Method were found to be the most sensitive to the small numbers of individuals in the *E. hermes* population studied. Some

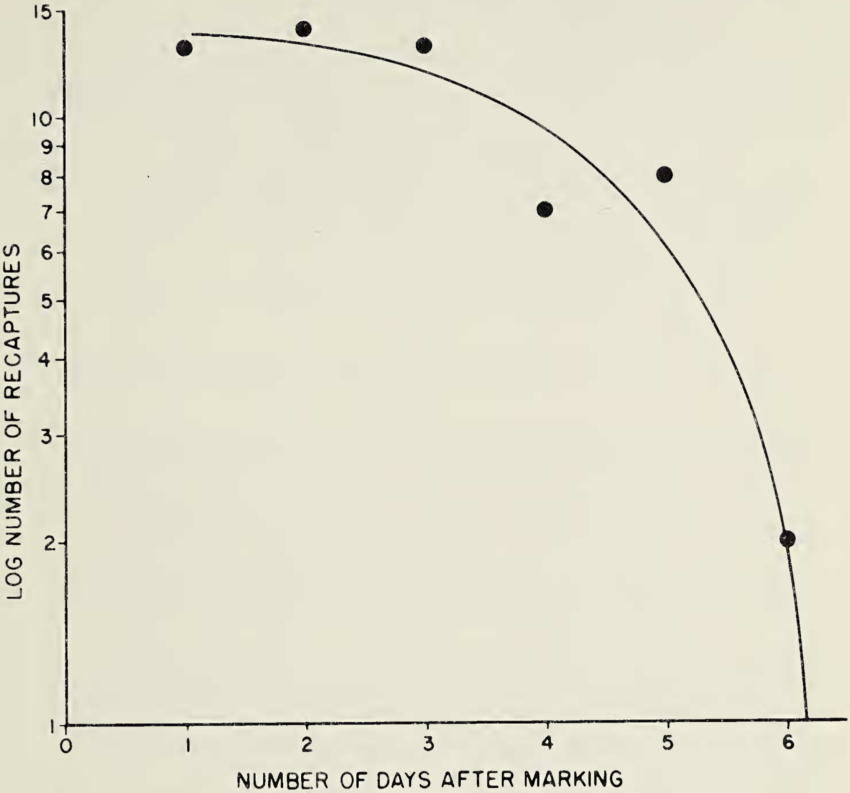

Fig. 5.—The log number of recaptured specimens taken on successive days following initial marking. See Fig. 4 and text for further explanation.

difficulty was encountered in applying Bailey's Triple Catch Method because of the requirement of recaptures on three successive days. The percentage of females in the population increased dramatically from 20 to 75% during the course of the project, probably due to the emergence of the second generation and increasing activity of egg-laying females. A survivorship curve with an expected average *maximum* of 6.25 days as life span for adults of both sexes was obtained.

ACKNOWLEDGMENTS

I wish to thank Dr. Thomas C. Emmel of the University of

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EDITORIAL CORRECTION REGARDING PRIORITY

Through inadvertent publication of the *Anartia amalthea* paper by Fosdick (1973) ahead of the preceeding paper by Kilduff (1973), an incorrect interpretation of priority of ideas may be created.

As Associate Editor of this *Journal,* I received and reviewed both papers editorially. Thomas S. Kilduff's paper was accepted for publication on July 5, 1972, and transmitted to the editor on that date. Kilduff's research was done during May 1972, and his paper contained a number of novel treatments of data, including certain graphical renderings of maximum life expectancy and survivorship (Fig. 4 and 5) which had not previously been published.

Fosdick's data on the population biology of *Anartia amalthea* were collected in September 1972 and both this later study and his paper (Fosdick, 1973) were modeled after the excellent approaches used by Kilduff. Fosdick's paper then, was to be the *second* paper of the two to appear in the *Journal.* It was accepted for publication on November 22, 1972, and transmitted to the California editorial offices on that date. Unfortunately, in my review of the Fosdick paper as Associate Editor, I neglected to state that it contained full credit to Kilduff's prior paper for the treatment and ideas used, and I did not specify to the Editor that the July 1972 paper by Kilduff had to appear ahead of that by Fosdick (the order of appearance of papers in pournals normally depends upon both the time received and the relative lengths of papers versus exact space needs for that journal issue). We wish to emphasize that full credit and future citations for the particular approaches uilized in the two papers should go to Kilduff (1973).

Thomas C. Emmel
Associate Editor

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FOSDICK, M. K. 1973. A population study of the neotropical nymphalid butterfly, *Anartia amalthea,* in Ecuador. *J. Res. Lepid.* 11(2): 65-80.

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